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# PATENT ABSTRACTS OF JAPAN

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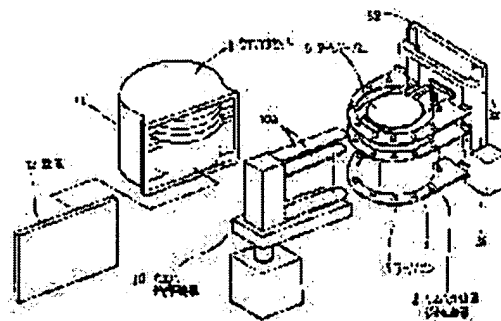
(72)Inventor : MIYASHITA MASAHIRO

## (54) WAFER ALIGNING DEVICE

### (57)Abstract:

PROBLEM TO BE SOLVED: To provide a wafer aligning device which is capable of easily aligning the centers of a plurality of wafers and making an alignment of wafers in a circumferential direction collectively.

SOLUTION: An aligning device 2 is equipped with a multi-stage mounting pad 3 where tapered pins 4 each widened towards their ends are arranged around the periphery of a wafer and a multi-stage turntables 5 which are provided to each of the mounting pads 3, rotated around the center of a circle surrounded with the tapered pins 4, and smaller than the circle, wherein the mounting pad 3 can be moved up or down relatively to the turntable 5. When a wafer is handed from a transfer arm 10a to the tapered pins 4, the periphery of the wafer is made to bear against the inner peripheral faces of the tapered pins 4, whereby the center of the wafer is aligned, and then the turntable receives the wafer and aligns it in a circumferential direction.



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**CLAIMS**


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[Claim(s)]

[Claim 1] The installation section for center position doubling constituted so that the taper section of breadth might be prepared along the periphery of a wafer at last, the periphery of a wafer might be regulated in respect of the taper of the taper section and alignment based on wafers might be performed, The rotation installation section located in an inner direction side rather than this circle while rotating around the core of the circle which connects said taper section, The detecting element which detects the notching section for alignment of the periphery section of the wafer held at said rotation installation section, It has the control section which controls the rotation of said rotation installation section based on the detecting signal from this detecting element, and performs alignment of the hoop direction of a wafer. The installation section for said alignment Alignment equipment of the wafer characterized by being relatively constituted possible [ rise and fall ] to the rotation installation section concerned so that delivery of a wafer can be performed between said rotation installation sections.

[Claim 2] Two or more steps of installation sections for center position doubling constituted so that the taper section of breadth might be prepared along the periphery of a wafer at last, the periphery section of a wafer might be regulated in respect of the taper of the taper section and alignment based on wafers might be performed, Two or more steps of rotation installation sections located in an inner direction side rather than this circle while rotating around the core of said circle which are prepared respectively corresponding to the installation section of a stage, and connects said taper section, [ two or more ] The detecting element which detects the notching section for alignment of the periphery section of the wafer held at said rotation installation section, It has the control section which controls the rotation of said rotation installation section based on the detecting signal from this detecting element, and performs alignment of the hoop direction of a wafer. The installation section for said center position doubling Alignment equipment of the wafer characterized by being relatively constituted possible [ rise and fall ] to the rotation installation section concerned so that delivery of a wafer can be performed between said rotation installation sections.

[Claim 3] Alignment equipment of the wafer according to claim 1 or 2 characterized by for between the lists of the taper section making both go up and down the penetration space of a wafer transfer arm relatively between nothing, a wafer transfer arm, and the installation section for center position doubling, and transferring a wafer.

[Claim 4] The installation section for each center position doubling is alignment equipment of the wafer according to claim 2 or 3 characterized by for each rotation installation section being supported by the 2nd common supporter material while being supported by the 1st common supporter material, and making it go up and down the 1st supporter material and the 2nd supporter material relatively.

[Claim 5] The rotation installation section is alignment equipment of the wafer according to claim 1, 2, 3, or 4 characterized by constituting the installation section for center position doubling possible [ rise and fall ] while the height location was fixed.

[Claim 6] The cassette installation section for laying a wafer cassette so that it may be equipment which a part of periphery section carries out opening, and carries out alignment of the wafer in the wafer cassette which a part of periphery section of a wafer has exposed from the opening and a wafer may become sideways, As opposed to the wafer in the wafer cassette laid in this cassette installation section Alignment equipment of the wafer characterized by having the press member which presses at least three places of the periphery section of the exposed wafer from the outside of a wafer cassette to a way side among wafers, and performs alignment based on wafers.

[Claim 7] A press member is alignment equipment of the wafer according to claim 6 characterized by being constituted with a rotatable roller around an almost perpendicular shaft.

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[Translation done.]

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the alignment equipment which can perform the core of a semi-conductor wafer, and alignment of a hoop direction.

[0002]

[Description of the Prior Art] Since there is directivity of a crystal in a wafer in case a semi-conductor wafer (henceforth a wafer) is generally processed or inspected, alignment must be carried out about direction of a wafer. For this reason, the notch of the shape of a straight line called a cage hula (orientation flat) is formed in the wafer, and the easy technique of performing cage hula doubling with a roller as indicated by JP,1-59739,B is known, using this.

[0003] At the heat treatment station which can bundle up cage hula doubling using such a roller, containing a wafer in a cassette, and can perform it, for example, heat-treats in batch, the device in which make a cassette into length and alignment of a wafer is performed is used. By the way, since a wafer must be correctly laid to an ion-implantation field or an exposure field when performing ion-implantation processing and pattern baking processing as opposed to a wafer, it is necessary to perform alignment also about the center position of a wafer.

[0004] Then, while doubling the sense of a wafer on a turntable as an approach of performing the sense (sense of a cage hula) of a wafer, and main alignment as indicated by the former, for example, JP,60-85536,A The technique which is made to move the turntable concerned in the direction of X, and the direction of Y, and carries out alignment of the core of a wafer, Or the sense of a wafer is doubled with the roller on a stage as indicated by JP,1-28503,A, and the technique of moving the stage concerned in the direction of X and the direction of Y too is known.

[0005]

[Problem(s) to be Solved by the Invention] If a cage hula is formed in a wafer, since notching of the large field will be carried out and it will become useless, in recently, it replaces with a cage hula in the periphery of a wafer, forming the notch of the shape of a semicircle called a notch is examined, and it becomes impossible by the way, to apply the device which carries out alignment of the wafer in a cassette with a roller for this reason as it is.

[0006] Furthermore, although the wafer cassette of closed mold is examined in order to suppress particle contamination of a wafer, alignment of a wafer cannot be performed within a cassette in this case. Then, as for the technique performed by putting one wafer at a time for a wafer on a turntable like previous statement sheets [ two or more ], for example, since five sheets are collectively transferred to a wafer boat, at the heat treatment station which heat-treats, for example in batch although a wafer must be picked out from a cassette and alignment must be performed, a throughput will fall.

[0007] moreover, the technique of performing alignment of the core of a wafer using a turntable like previous statement needs the drive of the direction of X, and the drive of the direction of Y, and since the amount of drives must be exact, a device becomes complicated -- it is expensive also in upper cost.

[0008] This invention is made under such a situation and the purpose is in offering the alignment equipment which can perform easily alignment based on wafers, and alignment of a hoop direction.

[0009] Other purposes of this invention are to offer the alignment equipment which can bundle up to two or more wafers and can perform main alignment and alignment of a hoop direction.

[0010] The purpose of further others of this invention is to offer the alignment equipment which can perform main alignment to the wafer in a wafer cassette.

[0011]

[Means for Solving the Problem] The installation section for center position doubling which the alignment equipment of this invention consisted of so that the taper section of breadth might be prepared along the periphery of a wafer at last, the periphery of a wafer might be regulated in respect of the taper of the taper section and alignment based on wafers might be performed, The rotation installation section located in an inner direction side rather than this circle while rotating around the core of the circle which connects said taper section, The detecting element which detects the notching section for alignment of the periphery section of the wafer held at

said rotation installation section, It has the control section which controls the rotation of said rotation installation section based on the detecting signal from this detecting element, and performs alignment of the hoop direction of a wafer. The installation section for said center position doubling It is characterized by being relatively constituted possible [ rise and fall ] to the rotation installation section concerned so that delivery of a wafer can be performed between said rotation installation sections.

[0012] Although this invention may prepare the installation section and one step of rotation installation section for center position doubling, if two or more steps are prepared, it can bundle up the alignment of a core and a hoop direction to two or more wafers, and can perform it. While the installation section for each center position doubling is supported by the 1st common supporter material in this case, each rotation installation section is supported by the 2nd common supporter material, and the configuration which makes it go up and down the 1st supporter material and the 2nd supporter material relatively can be used for it.

[0013] Moreover, in holding the inferior surface of tongue of a wafer by the wafer transfer arm and transferring to alignment equipment, make between the lists of the taper section into the penetration space of a wafer transfer arm, both are made to go up and down relatively between a wafer transfer arm and the installation section for center position doubling, and it transfers a wafer. When making both go up and down relatively, while the height location of the rotation installation section is fixed, it is desirable to constitute possible [ rise and fall of the installation section for center position doubling ].

[0014] Furthermore, the alignment equipment of the wafer concerning other invention The cassette installation section for laying a wafer cassette so that it may be equipment which a part of periphery section carries out opening, and carries out alignment of the wafer in the wafer cassette which a part of periphery section of a wafer has exposed from the opening and a wafer may become sideways, It is characterized by having the press member which presses at least three places of the periphery section of the exposed wafer from the outside of a wafer cassette to a way side among wafers to the wafer in the wafer cassette laid in this cassette installation section, and performs alignment based on wafers. It is desirable to use a rotatable roller for the surroundings of an almost perpendicular shaft as a press member.

[0015]

[Embodiment of the Invention] Drawing 1 is drawing showing a part of wafer transfer station containing the alignment equipment concerning the gestalt of operation of this invention, and the wafer cassette 1 of closed mold, the wafer transfer device 10, and the alignment equipment 2 of a wafer are formed in this transfer station. Said wafer cassette 1 is equipped with the case 11 with which the wafer retention groove was formed in multistage, and the lid 12 for closing airtightly opening which is the wafer carrying-in outlet of this case 11 so that 13 wafers W may be held to ledged.

[0016] Although said transfer device 10 is for delivering a wafer between a cassette 1 and alignment equipment 2, if the transfer station is combined with the vertical mold thermal treatment equipment (for example, if it is combined with the wafer boat by the vacuum processor again), it will transfer a wafer to the load lock chamber which has a wafer slot on multistage. While this transfer device 10 is equipped with two or more transfer arm 10a so that two or more wafers can be transferred collectively, and being constituted free [ attitude ease, rotation ease, and rise and fall ], array spacing (vertical spacing) of transfer arm 10a is changed.

[0017] The alignment equipment 2 of the wafer which is the gestalt of operation of this invention is equipped with the installation base 3 which is the installation section for wafer center position doubling arranged in two or more steps, for example, five steps. Each installation base 3 has the rise-and-fall pedestal 31 to which it was formed in in the shape of an abbreviation ring, and notching of the end face side was carried out so that it might expand to drawing 2 and drawing 3 and might be shown, and the taper pin 4 which is the taper section arranged by five a total of ten of this rise-and-fall pedestal 31 along the location corresponding to the periphery of Wafer W in each bilateral symmetry location.

[0018] Array spacing of the rise-and-fall pedestal 31 which the penetration space of said transfer arm 10a is formed between the taper pins 4 located in a line with right and left among these taper pins 4 at a tip side, and adjoins up and down is equivalent to array spacing of transfer arm 10a. A taper pin 4 is made from resin, such as Teflon (trade name), and as shown in drawing 2, cone-angle theta is respectively formed at 15 degrees in the shape of [ whose height h is 20mm ] a cone. The end face side of each rise-and-fall pedestal 31 is supported by the square shape common to right-and-left both the edges of the rise-and-fall frame 32 of a perpendicular posture.

[0019] Moreover, said alignment equipment 2 is equipped with five steps of turntables 5 as the rotation installation section which hold the rear face of a wafer and rotate horizontally. These turntables 5 are formed on the fixed pedestal 51 corresponding to the installation base 3, respectively. Rather than the installation base 3 where the fixed pedestal 51 corresponds, it is arranged at a lower part side and the end face side of the fixed pedestal 51 is attached common to the fixed plate 52 located in the tooth-back side of the rise-and-fall frame 32 concerned through the space surrounded with said rise-and-fall frame 32. In this example, the rise-and-fall frame 32 and the fixed pedestal 51 are equivalent to the 1st supporter material and the 2nd supporter material, respectively.

[0020] The mechanical component 54 containing a driving pulley 53, Motor M, etc. is formed in each of said fixed

pedestal 51. A turntable 5 can be rotated now around the perpendicular revolving shaft located at the core of a circular field of tying said taper pin 4, and is located in an upper part side rather than the rise-and-fall pedestal 31 in this example, the transfer device 55, for example, the belt, hung between driving pulleys 53.  
[0021]

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[0014] Furthermore, the alignment equipment of the wafer concerning other invention The cassette installation section for laying a wafer cassette so that it may be equipment which a part of periphery section carries out opening, and carries out alignment of the wafer in the wafer cassette which a part of periphery section of a wafer has exposed from the opening and a wafer may become sideways, It is characterized by having the press member which presses at least three places of the periphery section of the exposed wafer from the outside of a wafer cassette to a way side among wafers to the wafer in the wafer cassette laid in this cassette installation section, and performs alignment based on wafers. It is desirable to use a rotatable roller for the surroundings of an almost perpendicular shaft as a press member.

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[Embodiment of the Invention] Drawing 1 is drawing showing a part of wafer transfer station containing the alignment equipment concerning the gestalt of operation of this invention, and the wafer cassette 1 of closed mold, the wafer transfer device 10, and the alignment equipment 2 of a wafer are formed in this transfer station. Said wafer cassette 1 is equipped with the case 11 with which the wafer retention groove was formed in multistage, and the lid 12 for closing airtightly opening which is the wafer carrying-in outlet of this case 11 so that 13 wafers W may be held to ledged.

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[0017] The alignment equipment 2 of the wafer which is the gestalt of operation of this invention is equipped with the installation base 3 which is the installation section for wafer center position doubling arranged in two or more steps, for example, five steps. Each installation base 3 has the rise-and-fall pedestal 31 to which it was formed in in the shape of an abbreviation ring, and notching of the end face side was carried out so that it might expand to drawing 2 and drawing 3 and might be shown, and the taper pin 4 which is the taper section arranged by five a total of ten of this rise-and-fall pedestal 31 along the location corresponding to the periphery of Wafer W in each bilateral symmetry location.

[0018] Array spacing of the rise-and-fall pedestal 31 which the penetration space of said transfer arm 10a is formed between the taper pins 4 located in a line with right and left among these taper pins 4 at a tip side, and adjoins up and down is equivalent to array spacing of transfer arm 10a. A taper pin 4 is made from resin, such as Teflon (trade name), and as shown in drawing 2, cone-angle theta is respectively formed at 15 degrees in the shape of [ whose height h is 20mm ] a cone. The end face side of each rise-and-fall pedestal 31 is supported by the square shape common to right-and-left both the edges of the rise-and-fall frame 32 of a perpendicular posture.

[0019] Moreover, said alignment equipment 2 is equipped with five steps of turntables 5 as the rotation installation section which hold the rear face of a wafer and rotate horizontally. These turntables 5 are formed on the fixed pedestal 51 corresponding to the installation base 3, respectively. Rather than the installation base 3 where the fixed pedestal 51 corresponds, it is arranged at a lower part side and the end face side of the fixed pedestal 51 is attached common to the fixed plate 52 located in the tooth-back side of the rise-and-fall frame 32 concerned through the space surrounded with said rise-and-fall frame 32. In this example, the rise-and-fall frame 32 and the fixed pedestal 51 are equivalent to the 1st supporter material and the 2nd supporter material, respectively.

[0020] The mechanical component 54 containing a driving pulley 53, Motor M, etc. is formed in each of said fixed

pedestal 51. A turntable 5 can be rotated now around the perpendicular revolving shaft located at the core of a circular field of tying said taper pin 4, and is located in an upper part side rather than the rise-and-fall pedestal 31 in this example, the transfer device 55, for example, the belt, hung between driving pulleys 53.

[0021] Said rise-and-fall frame 32 is constituted so that it can go up and down by the elevator style 34 (refer to drawing 1 ) along with the perpendicular guide 56 prepared in the front-face side of said fixed plate 52.

[0022] Moreover, the photosensor 41 equipped with the detecting element, for example, the light sensing portion, and light-emitting part for detecting the cage hula (orientation flat) 200 shown in the notch 100 shown in drawing 5 (a) formed in the periphery of Wafer W as a notch for alignment or drawing 5 (b) is formed in each of said fixed pedestal 51. When Wafer W is laid in a turntable 5, these photosensors 41 are arranged so that a light-emitting part and a light sensing portion may counter on both sides of the periphery section of the wafer W.

[0023] The light-receiving output of said photosensor 41 is inputted into the control section 42 shown in drawing 2 . This control section 42 has the function which controls the rotation (angle of rotation) of a turntable 5 through a mechanical component 54 so that the notch 100 (or cage hula 200) of the wafer W on a turntable 5 is located in the predetermined sense based on this light-receiving output.

[0024] Next, an operation of the gestalt of the above-mentioned implementation is explained. Suppose that the cassette 1 of closed mold was laid in the cassette stage which a wafer transfer station does not illustrate now. This cassette 1 is always intercepted airtightly [ the storage space of a wafer ] from the outside with the lid 12, and a lid 12 is opened by the lid-open close device which is not illustrated at the time of a transfer of a wafer. And transfer arm 10a of the wafer transfer device 10 is made to advance into a cassette 1, five wafers W in a cassette 1 are dipped up collectively and held, and it transfers to the alignment equipment 2 of a wafer.

[0025] Array spacing of transfer arm 10a is 10mm when receiving a wafer from a cassette 1, but when moving to alignment equipment 2, it spreads to 30mm corresponding to array spacing of the installation base 3. Each transfer arm 10a advances into drawing 6 (a) from the corresponding turntable 5 to the location of 5mm [ for example, ] upper part so that it may be shown. At this time, the taper side of a taper pin 4 is put on the height level located in a lower part side from the periphery of Wafer W, the installation base 3 goes up by the rise of the rise-and-fall frame 32, the installation base 3 holds the periphery of Wafer W according to the taper side of a taper pin 4, as shown in drawing 6 (b), and it goes up further from that maintenance location. Thereby, Wafer W surfaces from transfer arm 10a, and, subsequently transfer arm 10a retreats from alignment equipment 2.

[0026] Main alignment is performed by holding Wafer W at a taper pin 4. That is, if the core of Wafer W has shifted since the periphery of Wafer W is regulated by the taper side of a taper pin 4 for example, the near periphery which the core has visited will contact the taper side of a taper pin 4 previously, and a periphery will be pushed back by the longitudinal direction by the rise of a taper side. Ten taper pins 4 will be in the condition that the wafer center position is correct, when Wafer W is supported with all the taper pins 4 as shown in drawing 6 (b) since it is arranged so that the point in the same height level of a taper side may be located along with the circle corresponding to the profile of Wafer W.

[0027] Then, the installation base 3 descends, and as shown in drawing 6 (c), the wafer W on the installation base 3 is received and passed to a turntable 5. Although a turntable 5 rotates by the mechanical component 54 after that, by the control-section 42 side, it can detect the notch 100 of Wafer W, and since the optical axis of a photosensor 4 is set up so that it may pass, the notch 100, for example, the notch, of Wafer W, it rotates a turntable 5 so that the location (sense) of the hoop direction of Wafer W may turn into a predetermined location based on the detecting signal of a photosensor 4.

[0028] In this way, the core of Wafer W and the alignment of the sense are completed, the installation base 3 goes up and the wafer W on a turntable 5 is received so that it may be shown subsequently to drawing 6 (d). Furthermore, transfer arm 10a advances between Wafer W and a turntable 5, as shown in drawing 6 (e), transfer arm 10a goes up and Wafer W is transferred to the wafer boat of for example, the vertical mold thermal treatment equipment which does not carry out reception illustration from the installation base 3.

[0029] According to the gestalt of above-mentioned operation, it is effective in the cure against a throughput at the time of a throughput improving, since it can carry out by putting in block center position doubling and the alignment of the sense to two or more wafers W, for example, using the cassette 1 of closed mold. Since a taper pin 4 performs center position doubling of Wafer W, this wafer W is delivered to a turntable 5 from a taper pin 4 and alignment about direction is performed, a configuration is easy. Furthermore, since the alignment device for every wafer is made multistage, a monopoly tooth space is also narrow and ends.

[0030] You fix the installation base 3 side and make it go up and down a turntable 5 side in this invention. Although you may make it make it go up and down the transfer arm 10a side when delivering a wafer to the installation base 3 side from transfer arm 10a In this case, since the case where the center position of a wafer has shifted most will be expected, transfer arm 10a will be located in the upper part side of a taper pin 4 and Wafer W will get down from there, the vertical migration length of Wafer W will become large, and a photosensor 41 will be enlarged that much. On the other hand, since the height level of Wafer W is fixed, the vertical migration length of Wafer W is small, therefore can miniaturize a photosensor 41, until Wafer W will be received and passed to the installation base 3 from transfer arm 10a, if you make it go up and down the installation base 3 side.

[0031] As the taper section, an inner circumference side is formed above instead of a taper pin in a taper side, it constitutes as the protruding line section continued and extended to a hoop direction, and you may make it support the whole (except for the location corresponding to the penetration space of a transfer arm etc.) periphery of a wafer. Moreover, one step may be prepared in this invention, without using as multistage the alignment device which consists of an installation base 3, a turntable 5, etc. In addition, if a transfer arm is the thing of the type which adsorbs the front face of a wafer, it is not necessary to form the penetration space of a transfer arm between the lists of a taper pin 4.

[0032] Next, it explains, referring to drawing 7 and drawing 8 about the gestalt of other operations of this invention. The gestalt of this operation is equipment for performing alignment based on wafers, containing a wafer in a wafer cassette. As a cassette, the standard cassette by which standardization is considered by SEMI, for example is used. Six in drawing is a wafer cassette, and it is sideways placed so that a wafer may become almost level on the cassette installation base 7 which is the cassette installation section. The top-face plate 61 and the inferior-surface-of-tongue plate 62 in a condition of every width of this cassette 6 are formed in the shape of somewhat larger radii of a minor diameter with Wafer W near [ it is mostly formed in a circle configuration and / the first transition side of these plates 61 and 62 ] a profile than the profile of Wafer W. While the side attachment walls 63 and 64 along the periphery of plates 61 and 62 are formed in the right-and-left both sides between said plates 61 and 62, a wall 65 is formed also in a plate 61 and the back end section between 62, and 13 steps of retention groove 66 for holding the periphery section of 13 wafers, respectively is formed in the inner skin of these walls 63, 64, and 65.

[0033] It is formed as opening 67 which makes the ejection of Wafer W, and intake between the first transition sections of the shape of radii of said plates 61 and 62. Moreover, notching of right-and-left both the edges on the backside is carried out, and walls 63 and 64 are opening 68 (refer to drawing 8 ) between the plate 61 in this part, and 62.

[0034] The press devices 7A and 7B which press the periphery section of the wafer in a cassette 6 are formed in the symmetry, and the alignment equipment which is the gestalt of operation of this invention is constituted according to these press devices 7A and 7B by the right-and-left both sides of said cassette 6. The press devices 7A and 7B are the same structures, and the rotatable roller 72 is formed in the location which counters the periphery section of the wafer W exposed near the right-and-left both ends of the first transition side opening 67 of a cassette 6, i.e., the location which counters the field facing the front end side of walls 63 and 64, around the press member 71, for example, a perpendicular shank.

[0035] This roller 72 is divided into every wafer W corresponding to the wafer W in a cassette 6, and corresponding to the height location of each wafer W, it is arranged in the height direction, a part for receipt number of sheets, for example, 13 roller 72a, of Wafer W in a cassette 6, and it is constituted. Between each roller 72a, the member which is not visible is prepared at a shank 71, and it can rotate now in drawing for securing spacing among Rollers 72a and 72a, without roller 72a and 72a rubbing.

[0036] Moreover, said roller 72 and the same roller 74 which can rotate freely around the perpendicular shank 73 are formed also in the location which counters the opening 68 formed in the right and left by the side of the posterior part of a cassette 6, and the lower limit section of each shanks 71 and 73 of these rollers 72 and 73 is being fixed to the common slide plate 8. Moreover, the upper limit side of each shanks 71 and 73 is connected mutually.

[0037] Said slide plate 8 is constituted free [ being guided to guide rails 81 and 82 / an attitude in the direction which intersects perpendicularly with the center line L to which cassette 6 order is connected ] (it can move to the longitudinal direction in drawing 7 like), and it is prepared in the flank of the slide plate 8, the mechanical component 83, for example, the air cylinder, for making the slide plate 8 concerned move. And when the center position of the wafer W in a cassette 6 is correct, the location of the four rollers 71 and 73 of the press devices 7A and 7B is carried out so that the periphery of the wafer W may be contacted. Teflon (trade name) is used as the quality of the material of these rollers 71 and 73.

[0038] With the gestalt of above-mentioned operation, the cassette 6 which contained 13 wafers W is sideways put, for example on the cassette installation base 7 of cassette input/output port, such as a vertical mold thermal treatment equipment. Although each rollers 71 and 73 of a transfer equipment are retreating to a cassette 6 and the location in which it does not interfere at this time After a cassette 6 is put on the installation base 7, the slide plate 8 is advanced by the air cylinder 83. The four periphery sections of the wafer W exposed from the openings 67 and 68 of a cassette 6 are pressed to a center line L side, respectively, and center position doubling of each wafer W in a cassette 6 is performed to coincidence by this. Each rollers 71 and 73 retreat after that, and the conveyance arm which is not illustrated goes the wafer W in a cassette 6 reception.

[0039] According to the gestalt of such operation, since main alignment can be performed to coincidence to the wafer W in a cassette 6, improvement in a throughput can be aimed at, it is made from the standard cassette as stated above with allowances to wafer size and a wafer core has only the location precision of extent which enters into 4mmphi, the gestalt of this operation is very effective. And since what is necessary is to perform alignment only about direction of a wafer after that when the wafer in a cassette can be transferred to a processing station

as it is and exact alignment is required about direction of a wafer from the processing a rough is sufficient as whose sense of a wafer to some extent, the device for alignment is also simple and ends.

[0040] Although not restricted to a roller as a member which presses the periphery of a wafer, since a roller will rotate even if the force joins a roller in a hoop direction at the time of press if a roller is used, generating of particle depended for rubbing can be suppressed. Moreover, although one roller common to each wafer as a roller may be used, if the roller divided for every wafer is used, since it will rotate independently according to a gap of the center position of each wafer, \*\*\*\* of a roller and a wafer periphery can be stopped further.

[0041] In addition, the class of cassette is not restricted to the standard cassette shown in drawing 7 . Moreover, press of the periphery of a wafer is not limited to four places that what is necessary is just three or more places.

[0042]

[Effect of the Invention] Since the installation section and the rotation installation section equipped with the taper section for wafer center position doubling are combined according to this invention, the core of a wafer and alignment of a hoop direction can be performed with an easy configuration. Moreover, by establishing two or more steps of alignment devices which consist of these installation section, it can bundle up to two or more wafers, and alignment can be performed. Moreover, since the periphery section of the wafer exposed from the wafer cassette is pressed from at least 3 directions according to other invention, main alignment can be performed to the wafer in a wafer cassette.

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TECHNICAL FIELD

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[Field of the Invention] This invention relates to the alignment equipment which can perform the core of a semiconductor wafer, and alignment of a hoop direction.

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PRIOR ART

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[Description of the Prior Art] Since there is directivity of a crystal in a wafer in case a semi-conductor wafer (henceforth a wafer) is generally processed or inspected, alignment must be carried out about direction of a wafer. For this reason, the notch of the shape of a straight line called a cage hula (orientation flat) is formed in the wafer, and the easy technique of performing cage hula doubling with a roller as indicated by JP,1-59739,B is known, using this.

[0003] At the heat treatment station which can bundle up cage hula doubling using such a roller, containing a wafer in a cassette, and can perform it, for example, heat-treats in batch, the device in which make a cassette into length and alignment of a wafer is performed is used. By the way, since a wafer must be correctly laid to an ion-implantation field or an exposure field when performing ion-implantation processing and pattern baking processing as opposed to a wafer, it is necessary to perform alignment also about the center position of a wafer.

[0004] Then, it is while doubling the sense of a wafer on a turntable as an approach of performing the sense (sense of a cage hula) of a wafer, and main alignment as indicated by the former, for example, JP,60-85536,A, the technique which is made to move the turntable concerned in the direction of X, and the direction of Y, and carries out alignment of the core of a wafer -- or the sense of a wafer is doubled with the roller on a stage as indicated by JP,1-28503,A, and the technique of moving the stage concerned in the direction of X and the direction of Y too is known.

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EFFECT OF THE INVENTION

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[Effect of the Invention] Since the installation section and the rotation installation section equipped with the taper section for wafer center position doubling are combined according to this invention, the core of a wafer and alignment of a hoop direction can be performed with an easy configuration. Moreover, by establishing two or more steps of alignment devices which consist of these installation section, it can bundle up to two or more wafers, and alignment can be performed. Moreover, since the periphery section of the wafer exposed from the wafer cassette is pressed from at least 3 directions according to other invention, main alignment can be performed to the wafer in a wafer cassette.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] If a cage hula is formed in a wafer, since notching of the large field will be carried out and it will become useless, in recently, it replaces with a cage hula in the periphery of a wafer, forming the notch of the shape of a semicircle called a notch is examined, and it becomes impossible by the way, to apply the device which carries out alignment of the wafer in a cassette with a roller for this reason as it is.

[0006] Furthermore, although the wafer cassette of closed mold is examined in order to suppress particle contamination of a wafer, alignment of a wafer cannot be performed within a cassette in this case. Then, as for the technique performed by putting one wafer at a time for a wafer on a turntable like previous statement sheets [ two or more ], for example, since five sheets are collectively transferred to a wafer boat, at the heat treatment station which heat-treats, for example in batch although a wafer must be picked out from a cassette and alignment must be performed, a throughput will fall.

[0007] moreover, the technique of performing alignment of the core of a wafer using a turntable like previous statement needs the drive of the direction of X, and the drive of the direction of Y, and since the amount of drives must be exact, a device becomes complicated -- it is expensive also in upper cost.

[0008] This invention is made under such a situation and the purpose is in offering the alignment equipment which can perform easily alignment based on wafers, and alignment of a hoop direction.

[0009] Other purposes of this invention are to offer the alignment equipment which can bundle up to two or more wafers and can perform main alignment and alignment of a hoop direction.

[0010] The purpose of further others of this invention is to offer the alignment equipment which can perform main alignment to the wafer in a wafer cassette.

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## MEANS

[Means for Solving the Problem] The installation section for center position doubling which the alignment equipment of this invention consisted of so that the taper section of breadth might be prepared along the periphery of a wafer at last, the periphery of a wafer might be regulated in respect of the taper of the taper section and alignment based on wafers might be performed, The rotation installation section located in an inner direction side rather than this circle while rotating around the core of the circle which connects said taper section, The detecting element which detects the notching section for alignment of the periphery section of the wafer held at said rotation installation section, It has the control section which controls the rotation of said rotation installation section based on the detecting signal from this detecting element, and performs alignment of the hoop direction of a wafer. The installation section for said center position doubling It is characterized by being relatively constituted possible [ rise and fall ] to the rotation installation section concerned so that delivery of a wafer can be performed between said rotation installation sections.

[0012] Although this invention may prepare the installation section and one step of rotation installation section for center position doubling, if two or more steps are prepared, it can bundle up the alignment of a core and a hoop direction to two or more wafers, and can perform it. While the installation section for each center position doubling is supported by the 1st common supporter material in this case, each rotation installation section is supported by the 2nd common supporter material, and the configuration which makes it go up and down the 1st supporter material and the 2nd supporter material relatively can be used for it.

[0013] Moreover, in holding the inferior surface of tongue of a wafer by the wafer transfer arm and transferring to alignment equipment, make between the lists of the taper section into the penetration space of a wafer transfer arm, both are made to go up and down relatively between a wafer transfer arm and the installation section for center position doubling, and it transfers a wafer. When making both go up and down relatively, while the height location of the rotation installation section is fixed, it is desirable to constitute possible [ rise and fall of the installation section for center position doubling ].

[0014] Furthermore, the alignment equipment of the wafer concerning other invention The cassette installation section for laying a wafer cassette so that it may be equipment which a part of periphery section carries out opening, and carries out alignment of the wafer in the wafer cassette which a part of periphery section of a wafer has exposed from the opening and a wafer may become sideways, It is characterized by having the press member which presses at least three places of the periphery section of the exposed wafer from the outside of a wafer cassette to a way side among wafers to the wafer in the wafer cassette laid in this cassette installation section, and performs alignment based on wafers. It is desirable to use a rotatable roller for the surroundings of an almost perpendicular shaft as a press member.

[0015]

[Embodiment of the Invention] Drawing 1 is drawing showing a part of wafer transfer station containing the alignment equipment concerning the gestalt of operation of this invention, and the wafer cassette 1 of closed mold, the wafer transfer device 10, and the alignment equipment 2 of a wafer are formed in this transfer station. Said wafer cassette 1 is equipped with the case 11 with which the wafer retention groove was formed in multistage, and the lid 12 for closing airtightly opening which is the wafer carrying-in outlet of this case 11 so that 13 wafers W may be held to ledged.

[0016] Although said transfer device 10 is for delivering a wafer between a cassette 1 and alignment equipment 2, if the transfer station is combined with the vertical mold thermal treatment equipment (for example, if it is combined with the wafer boat by the vacuum processor again), it will transfer a wafer to the load lock chamber which has a wafer slot on multistage. While this transfer device 10 is equipped with two or more transfer arm 10a so that two or more wafers can be transferred collectively, and being constituted free [ attitude ease, rotation ease, and rise and fall ], array spacing (vertical spacing) of transfer arm 10a is changed.

[0017] The alignment equipment 2 of the wafer which is the gestalt of operation of this invention is equipped with the installation base 3 which is the installation section for wafer center position doubling arranged in two or more steps, for example, five steps. Each installation base 3 has the rise-and-fall pedestal 31 to which it was formed in in the shape of an abbreviation ring, and notching of the end face side was carried out so that it might expand to

drawing 2 and drawing 3 and might be shown, and the taper pin 4 which is the taper section arranged by five a total of ten of this rise-and-fall pedestal 31 along the location corresponding to the periphery of Wafer W in each bilateral symmetry location.

[0018] Array spacing of the rise-and-fall pedestal 31 which the penetration space of said transfer arm 10a is formed between the taper pins 4 located in a line with right and left among these taper pins 4 at a tip side, and adjoins up and down is equivalent to array spacing of transfer arm 10a. A taper pin 4 is made from resin, such as Teflon (trade name), and as shown in drawing 2, cone-angle theta is respectively formed at 15 degrees in the shape of [ whose height h is 20mm ] a cone. The end face side of each rise-and-fall pedestal 31 is supported by the square shape common to right-and-left both the edges of the rise-and-fall frame 32 of a perpendicular posture.

[0019] Moreover, said alignment equipment 2 is equipped with five steps of turntables 5 as the rotation installation section which hold the rear face of a wafer and rotate horizontally. These turntables 5 are formed on the fixed pedestal 51 corresponding to the installation base 3, respectively. Rather than the installation base 3 where the fixed pedestal 51 corresponds, it is arranged at a lower part side and the end face side of the fixed pedestal 51 is attached common to the fixed plate 52 located in the tooth-back side of the rise-and-fall frame 32 concerned through the space surrounded with said rise-and-fall frame 32. In this example, the rise-and-fall frame 32 and the fixed pedestal 51 are equivalent to the 1st supporter material and the 2nd supporter material, respectively.

[0020] The mechanical component 54 containing a driving pulley 53, Motor M, etc. is formed in each of said fixed pedestal 51. A turntable 5 can be rotated now around the perpendicular revolving shaft located at the core of a circular field of tying said taper pin 4, and is located in an upper part side rather than the rise-and-fall pedestal 31 in this example, the transfer device 55, for example, the belt, hung between driving pulleys 53.

[0021] Said rise-and-fall frame 32 is constituted so that it can go up and down by the elevator style 34 (refer to drawing 1) along with the perpendicular guide 56 prepared in the front-face side of said fixed plate 52.

[0022] Moreover, the photosensor 41 equipped with the detecting element, for example, the light sensing portion, and light-emitting part for detecting the cage hula (orientation flat) 200 shown in the notch 100 shown in drawing 5 (a) formed in the periphery of Wafer W as a notch for alignment or drawing 5 (b) is formed in each of said fixed pedestal 51. When Wafer W is laid in a turntable 5, these photosensors 41 are arranged so that a light-emitting part and a light sensing portion may counter on both sides of the periphery section of the wafer W.

[0023] The light-receiving output of said photosensor 41 is inputted into the control section 42 shown in drawing 2. This control section 42 has the function which controls the rotation (angle of rotation) of a turntable 5 through a mechanical component 54 so that the notch 100 (or cage hula 200) of the wafer W on a turntable 5 is located in the predetermined sense based on this light-receiving output.

[0024] Next, an operation of the gestalt of the above-mentioned implementation is explained. Suppose that the cassette 1 of closed mold was laid in the cassette stage which a wafer transfer station does not illustrate now. This cassette 1 is always intercepted airtightly [ the storage space of a wafer ] from the outside with the lid 12, and a lid 12 is opened by the lid-open close device which is not illustrated at the time of a transfer of a wafer. And transfer arm 10a of the wafer transfer device 10 is made to advance into a cassette 1, five wafers W in a cassette 1 are dipped up collectively and held, and it transfers to the alignment equipment 2 of a wafer.

[0025] Array spacing of transfer arm 10a is 10mm when receiving a wafer from a cassette 1, but when moving to alignment equipment 2, it spreads to 30mm corresponding to array spacing of the installation base 3. Each transfer arm 10a advances into drawing 6 (a) from the corresponding turntable 5 to the location of 5mm [ for example, ] upper part so that it may be shown. At this time, the taper side of a taper pin 4 is put on the height level located in a lower part side from the periphery of Wafer W, the installation base 3 goes up by the rise of the rise-and-fall frame 32, the installation base 3 holds the periphery of Wafer W according to the taper side of a taper pin 4, as shown in drawing 6 (b), and it goes up further from that maintenance location. Thereby, Wafer W surfaces from transfer arm 10a, and, subsequently transfer arm 10a retreats from alignment equipment 2.

[0026] Main alignment is performed by holding Wafer W at a taper pin 4. That is, if the core of Wafer W has shifted since the periphery of Wafer W is regulated by the taper side of a taper pin 4 for example, the near periphery which the core has visited will contact the taper side of a taper pin 4 previously, and a periphery will be pushed back by the longitudinal direction by the rise of a taper side. Ten taper pins 4 will be in the condition that the wafer center position is correct, when Wafer W is supported with all the taper pins 4 as shown in drawing 6 (b) since it is arranged so that the point in the same height level of a taper side may be located along with the circle corresponding to the profile of Wafer W.

[0027] Then, the installation base 3 descends, and as shown in drawing 6 (c), the wafer W on the installation base 3 is received and passed to a turntable 5. Although a turntable 5 rotates by the mechanical component 54 after that, by the control-section 42 side, it can detect the notch 100 of Wafer W, and since the optical axis of a photosensor 4 is set up so that it may pass, the notch 100, for example, the notch, of Wafer W, it rotates a turntable 5 so that the location (sense) of the hoop direction of Wafer W may turn into a predetermined location based on the detecting signal of a photosensor 4.

[0028] In this way, the core of Wafer W and the alignment of the sense are completed, the installation base 3

goes up and the wafer W on a turntable 5 is received so that it may be shown subsequently to drawing 6 (d). Furthermore, transfer arm 10a advances between Wafer W and a turntable 5, as shown in drawing 6 (e), transfer arm 10a goes up and Wafer W is transferred to the wafer boat of for example, the vertical mold thermal treatment equipment which does not carry out reception illustration from the installation base 3.

[0029] According to the gestalt of above-mentioned operation, it is effective in the cure against a throughput at the time of a throughput improving, since it can carry out by putting in block center position doubling and the alignment of the sense to two or more wafers W, for example, using the cassette 1 of closed mold. Since a taper pin 4 performs center position doubling of Wafer W, this wafer W is delivered to a turntable 5 from a taper pin 4 and alignment about direction is performed, a configuration is easy. Furthermore, since the alignment device for every wafer is made multistage, a monopoly tooth space is also narrow and ends.

[0030] You fix the installation base 3 side and make it go up and down a turntable 5 side in this invention. Although you may make it make it go up and down the transfer arm 10a side when delivering a wafer to the installation base 3 side from transfer arm 10a In this case, since the case where the center position of a wafer has shifted most will be expected, transfer arm 10a will be located in the upper part side of a taper pin 4 and Wafer W will get down from there, the vertical migration length of Wafer W will become large, and a photosensor 41 will be enlarged that much. On the other hand, since the height level of Wafer W is fixed, the vertical migration length of Wafer W is small, therefore can miniaturize a photosensor 41, until Wafer W will be received and passed to the installation base 3 from transfer arm 10a, if you make it go up and down the installation base 3 side.

[0031] As the taper section, an inner circumference side is formed above instead of a taper pin in a taper side, it constitutes as the protruding line section continued and extended to a hoop direction, and you may make it support the whole (except for the location corresponding to the penetration space of a transfer arm etc.) periphery of a wafer. Moreover, one step may be prepared in this invention, without using as multistage the alignment device which consists of an installation base 3, a turntable 5, etc. In addition, if a transfer arm is the thing of the type which adsorbs the front face of a wafer, it is not necessary to form the penetration space of a transfer arm between the lists of a taper pin 4.

[0032] Next, it explains, referring to drawing 7 and drawing 8 about the gestalt of other operations of this invention. The gestalt of this operation is equipment for performing alignment based on wafers, containing a wafer in a wafer cassette. As a cassette, the standard cassette by which standardization is considered by SEMI, for example is used. Six in drawing 1 is a wafer cassette, and it is sideways placed so that a wafer may become almost level on the cassette installation base 7 which is the cassette installation section. The top-face plate 61 and the inferior-surface-of-tongue plate 62 in a condition of every width of this cassette 6 are formed in the shape of somewhat larger radii of a minor diameter with Wafer W near [ it is mostly formed in a circle configuration and / the first transition side of these plates 61 and 62 ] a profile than the profile of Wafer W. While the side attachment walls 63 and 64 along the periphery of plates 61 and 62 are formed in the right-and-left both sides between said plates 61 and 62, a wall 65 is formed also in a plate 61 and the back end section between 62, and 13 steps of retention groove 66 for holding the periphery section of 13 wafers, respectively is formed in the inner skin of these walls 63, 64, and 65.

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[0034] The press devices 7A and 7B which press the periphery section of the wafer in a cassette 6 are formed in the symmetry, and the alignment equipment which is the gestalt of operation of this invention is constituted according to these press devices 7A and 7B by the right-and-left both sides of said cassette 6. The press devices 7A and 7B are the same structures, and the rotatable roller 72 is formed in the location which counters the periphery section of the wafer W exposed near the right-and-left both ends of the first transition side opening 67 of a cassette 6, i.e., the location which counters the field facing the front end side of walls 63 and 64, around the press member 71, for example, a perpendicular shank.

[0035] This roller 72 is divided into every wafer W corresponding to the wafer W in a cassette 6, and corresponding to the height location of each wafer W, it is arranged in the height direction, a part for receipt number of sheets, for example, 13 roller 72a, of Wafer W in a cassette 6, and it is constituted. Between each roller 72a, the member which is not visible is prepared at a shank 71, and it can rotate now in drawing for securing spacing among Rollers 72a and 72a, without roller 72a and 72a rubbing.

[0036] Moreover, said roller 72 and the same roller 74 which can rotate freely around the perpendicular shank 73 are formed also in the location which counters the opening 68 formed in the right and left by the side of the posterior part of a cassette 6, and the lower limit section of each shanks 71 and 73 of these rollers 72 and 73 is being fixed to the common slide plate 8. Moreover, the upper limit side of each shanks 71 and 73 is connected mutually.

[0037] Said slide plate 8 is constituted free [ being guided to guide rails 81 and 82 / an attitude in the direction which intersects perpendicularly with the center line L to which cassette 6 order is connected ] (it can move to the

longitudinal direction in drawing 7 like), and it is prepared in the flank of the slide plate 8, the mechanical component 83, for example, the air cylinder, for making the slide plate 8 concerned move. And when the center position of the wafer W in a cassette 6 is correct, the location of the four rollers 71 and 73 of the press devices 7A and 7B is carried out so that the periphery of the wafer W may be contacted. Teflon (trade name) is used as the quality of the material of these rollers 71 and 73.

[0038] With the gestalt of above-mentioned operation, the cassette 6 which contained 13 wafers W is sideways put, for example on the cassette installation base 7 of cassette input/output port, such as a vertical mold thermal treatment equipment. Although each rollers 71 and 73 of a transfer equipment are retreating to a cassette 6 and the location in which it does not interfere at this time After a cassette 6 is put on the installation base 7, the slide plate 8 is advanced by the air cylinder 83. The four periphery sections of the wafer W exposed from the openings 67 and 68 of a cassette 6 are pressed to a center line L side, respectively, and center position doubling of each wafer W in a cassette 6 is performed to coincidence by this. Each rollers 71 and 73 retreat after that, and the conveyance arm which is not illustrated goes the wafer W in a cassette 6 reception.

[0039] According to the gestalt of such operation, since main alignment can be performed to coincidence to the wafer W in a cassette 6, improvement in a throughput can be aimed at, it is made from the standard cassette as stated above with allowances to wafer size and a wafer core has only the location precision of extent which enters into 4mmphi, the gestalt of this operation is very effective. And since what is necessary is to perform alignment only about direction of a wafer after that when the wafer in a cassette can be transferred to a processing station as it is and exact alignment is required about direction of a wafer from the processing a rough is sufficient as whose sense of a wafer to some extent, the device for alignment is also simple and ends.

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[0041] In addition, the class of cassette is not restricted to the standard cassette shown in drawing 7 . Moreover, press of the periphery of a wafer is not limited to four places that what is necessary is just three or more places.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the outline perspective view showing a part of transfer station containing the alignment equipment concerning the gestalt of operation of this invention.

[Drawing 2] It is the perspective view showing the alignment equipment concerning the gestalt of operation of this invention.

[Drawing 3] It is the side elevation showing the alignment equipment concerning the gestalt of operation of this invention.

[Drawing 4] It is the side elevation expanding and showing the taper pin of the alignment equipment concerning the gestalt of operation of this invention.

[Drawing 5] It is the top view showing a wafer.

[Drawing 6] It is the operation explanatory view showing the situation of the alignment of a wafer.

[Drawing 7] It is the perspective view showing the alignment equipment concerning the gestalt of other operations of this invention.

[Drawing 8] It is the top view showing the alignment equipment concerning the gestalt of other operations of this invention.

[Description of Notations]

- 1 Wafer Cassette
- 10 Wafer Alignment Device
- 2 Alignment Equipment of Wafer
- 3 Installation Base
- 31 Rise-and-Fall Pedestal
- 32 Rise-and-Fall Frame
- 4 Taper Pin
- 41 Photosensor
- 42 Control Section
- 5 Turntable
- 51 Fixed Pedestal
- 52 Fixed Plate
- 6 Wafer Cassette
- 61 Top-Face Plate
- 62 Inferior-Surface-of-Tongue Plate
- 67 68 Opening
- 7A, 7B Press device
- 72 73 Roller as a press member
- 8 Slide Plate
- 83 Air Cylinder

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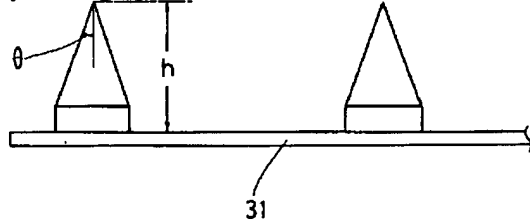
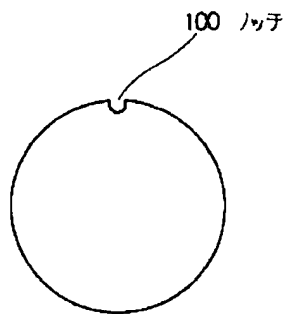
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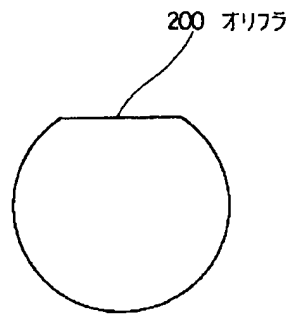
1. This document has been translated by computer. So the translation may not reflect the original precisely.
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## DRAWINGS

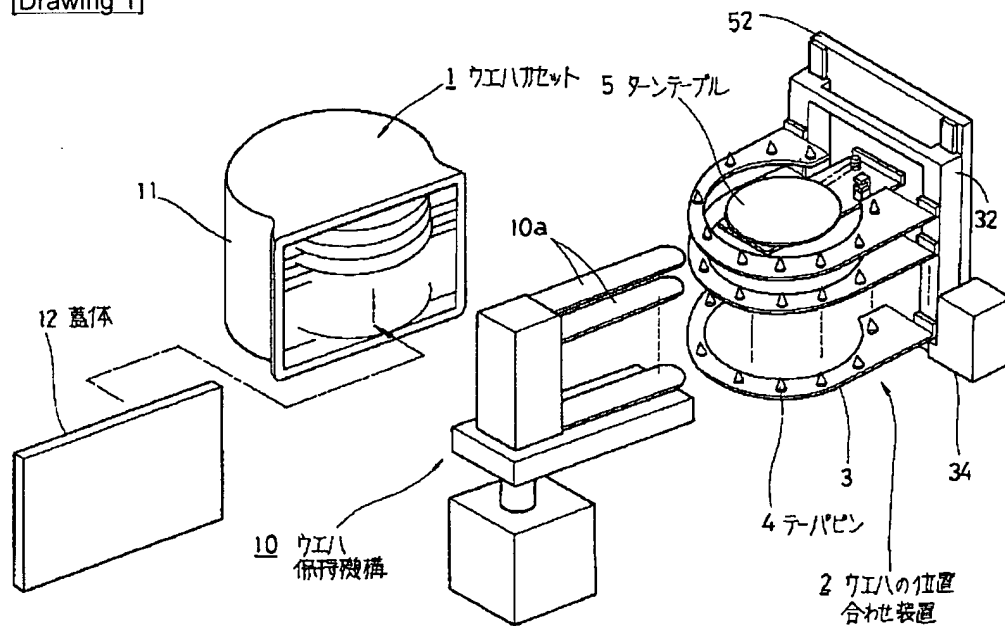
[Drawing 4]

[Drawing 5]  
(a)

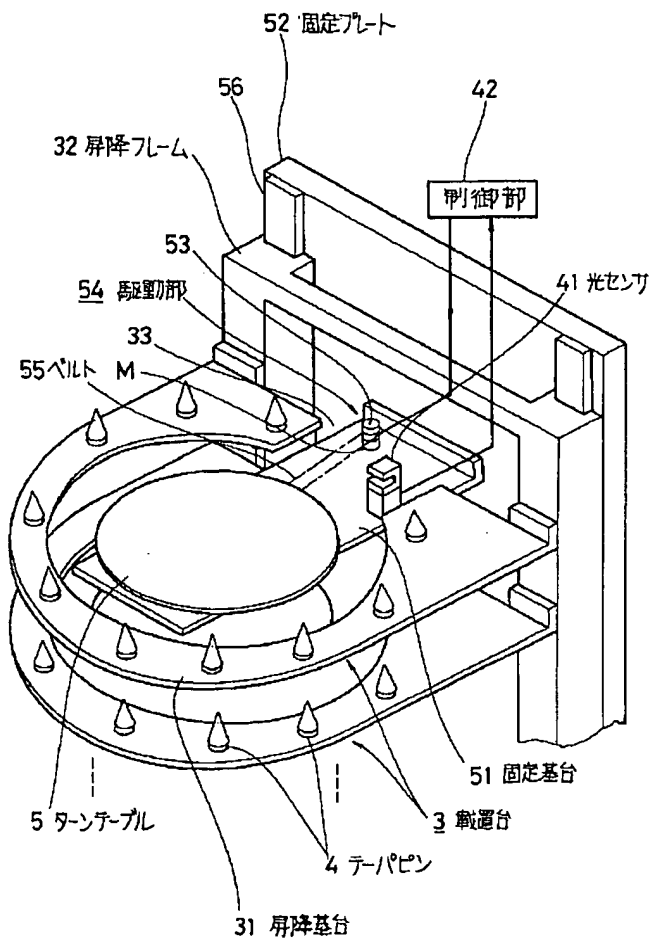
(b)



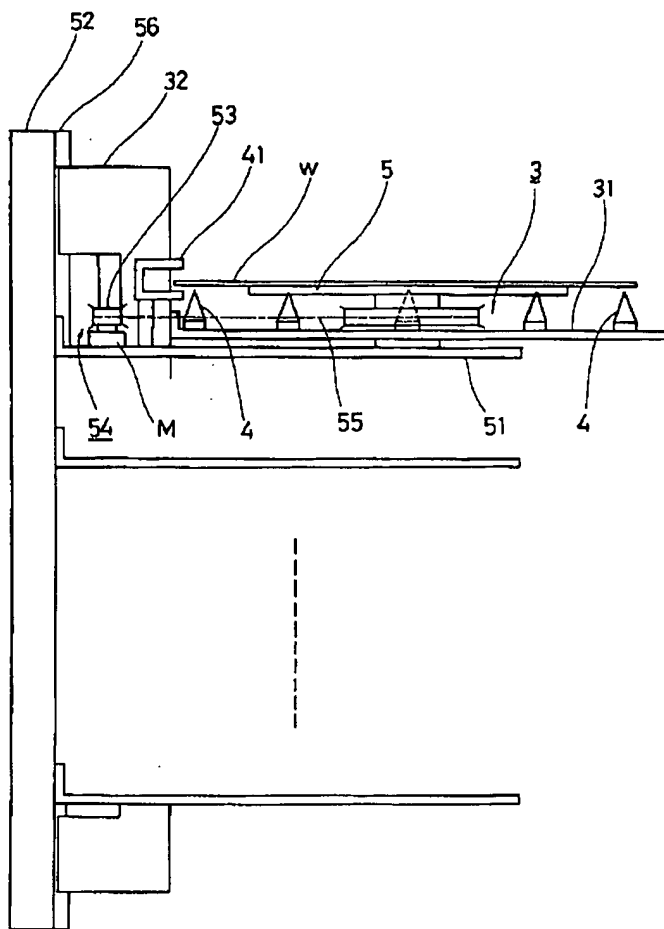
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[Drawing 2]

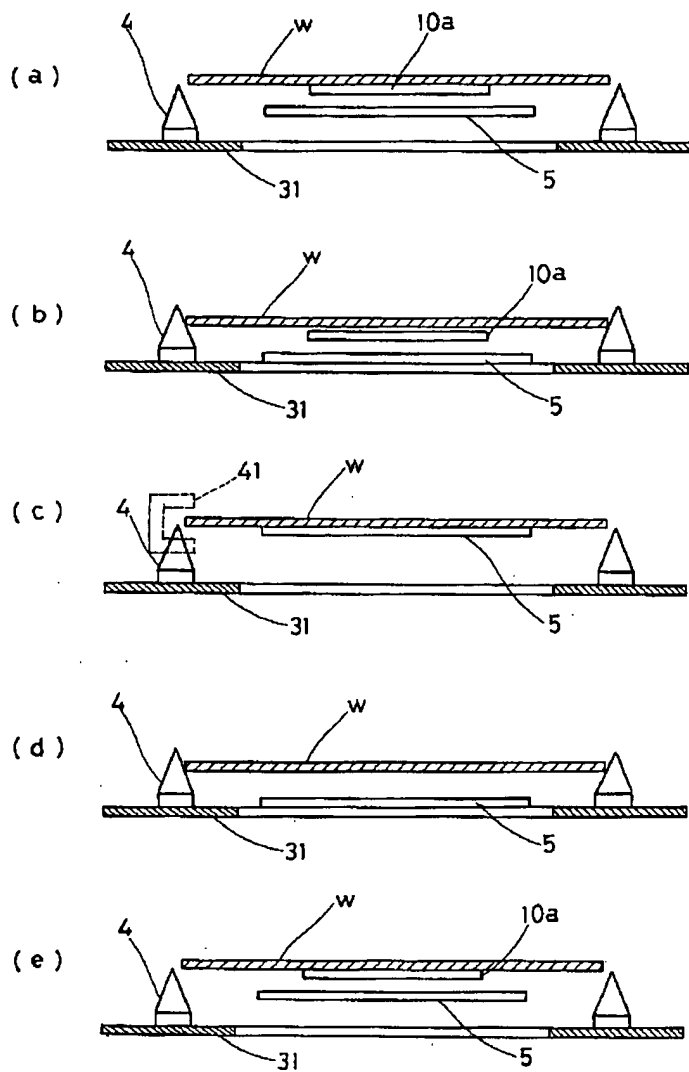


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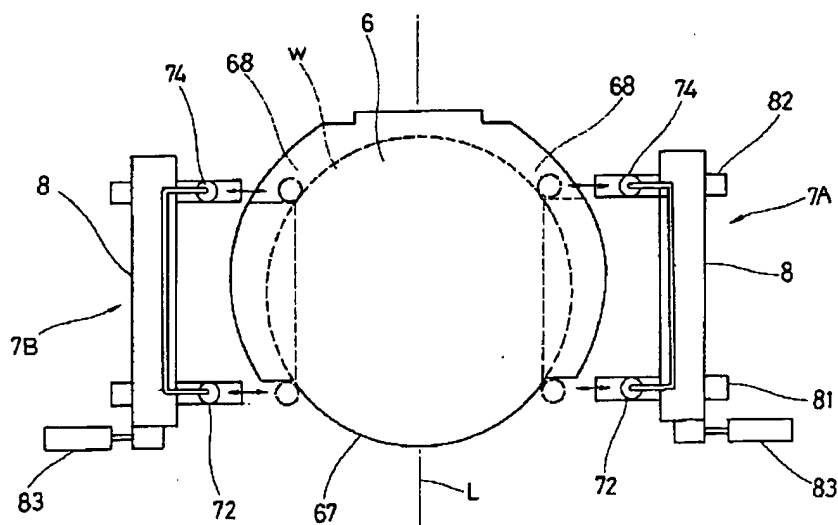


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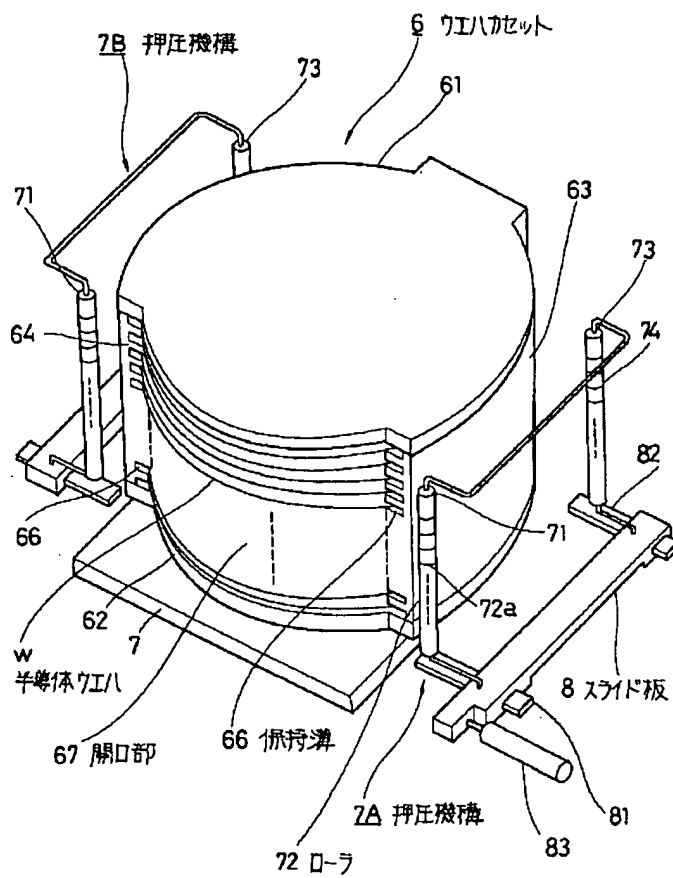




[Drawing 8]



[Drawing 7]



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(71)出願人 000219967

東京エレクトロン株式会社

東京都港区赤坂5丁目3番6号

(72)発明者 宮下 正弘

神奈川県津久井郡城山町町屋1丁目2番41

号 東京エレクトロン東北株式会社相模事業所内

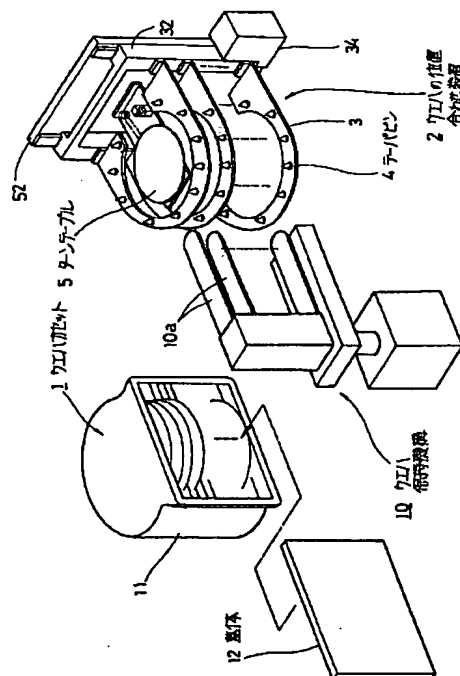
(74)代理人 弁理士 井上 俊夫

(54)【発明の名称】 ウエハの位置合わせ装置

(57)【要約】

【課題】 ウエハ中心の位置合わせ及び周方向の位置合わせを簡単に行うことのできる装置、及びこれらの位置合わせを複数枚のウエハに対して一括して行うことのできる装置を提供すること。

【解決手段】 未広がりテーパ部例えばテーパピン4がウエハの周縁に沿って配置された複数段の載置台3と、これら載置台3に夫々対して設けられ、テーパピン4を結ぶ円の中心のまわりに回転すると共に、この円よりも内方側に位置する複数段のターンテーブル5とを備えており、載置台3がターンテーブル5に対して相対的に昇降できるようになっている。ウエハWが移載アーム10aからテーパピン4に受け渡されるとウエハWの周縁がテーパピン4の内周面に当接して中心位置合わせが行われ、次いでターンテーブル5がウエハWを受け取って周方向の位置合わせが行われる。



## 【特許請求の範囲】

【請求項 1】 末広がりのテーパ部がウエハの周縁に沿って設けられ、ウエハの周縁がテーパ部のテーパ面で規制されてウエハ中心の位置合わせが行われるように構成された中心位置合わせ用の載置部と、前記テーパ部を結ぶ円の中心部のまわりに回転すると共にこの円よりも内方側に位置する回転載置部と、前記回転載置部に保持されたウエハの周縁部の位置合わせ用切り欠き部を検出する検出部と、この検出部からの検出信号に基づいて前記回転載置部の回転量を制御してウエハの周方向の位置合わせを行う制御部と、を備え、前記位置合わせ用の載置部は、前記回転載置部との間でウエハの受け渡しができるように当該回転載置部に対して相対的に昇降可能に構成されたことを特徴とするウエハの位置合わせ装置。

【請求項 2】 末広がりのテーパ部がウエハの周縁に沿って設けられ、ウエハの周縁部がテーパ部のテーパ面で規制されてウエハ中心の位置合わせが行われるように構成された複数段の中心位置合わせ用の載置部と、前記複数段の載置部に夫々対応して設けられ、前記テーパ部を結ぶ円の中心部のまわりに回転すると共にこの円よりも内方側に位置する複数段の回転載置部と、前記回転載置部に保持されたウエハの周縁部の位置合わせ用切り欠き部を検出する検出部と、この検出部からの検出信号に基づいて前記回転載置部の回転量を制御してウエハの周方向の位置合わせを行う制御部と、を備え、前記中心位置合わせ用の載置部は、前記回転載置部との間でウエハの受け渡しができるように当該回転載置部に対して相対的に昇降可能に構成されたことを特徴とするウエハの位置合わせ装置。

【請求項 3】 テーパ部の並びの間が、ウエハ移載アームの進入空間をなし、ウエハ移載アームと中心位置合わせ用の載置部との間で両者を相対的に昇降させてウエハの移載を行うことを特徴とする請求項 1 または 2 記載のウエハの位置合わせ装置。

【請求項 4】 各中心位置合わせ用の載置部は共通の第 1 の支持部材に支持されると共に、各回転載置部は、共通の第 2 の支持部材に支持され、第 1 の支持部材と第 2 の支持部材とを相対的に昇降させることを特徴とする請求項 2 または 3 記載のウエハの位置合わせ装置。

【請求項 5】 回転載置部は高さ位置が固定される一方、中心位置合わせ用の載置部は昇降可能に構成されたことを特徴とする請求項 1、2、3 または 4 記載のウエハの位置合わせ装置。

【請求項 6】 周縁部の一部が開口し、その開口部からウエハの周縁部の一部が露出しているウエハカセット内のウエハを位置合わせする装置であって、ウエハが横向きになるようにウエハカセットを載置する

ためのカセット載置部と、

このカセット載置部に載置されたウエハカセット内のウエハに対して、露出しているウエハの周縁部の少なくとも 3 か所をウエハカセットの外側からウエハの内方側に押圧してウエハ中心の位置合わせを行う押圧部材と、を備えたことを特徴とするウエハの位置合わせ装置。

【請求項 7】 押圧部材は、ほぼ垂直な軸の回りに回転可能なローラにより構成されたことを特徴とする請求項 6 記載のウエハの位置合わせ装置。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、半導体ウエハの中心及び周方向の位置合わせを行うことのできる位置合わせ装置に関する。

【0002】

【従来の技術】一般に半導体ウエハ（以下ウエハという）を処理あるいは検査する際に、ウエハには結晶の方向性があることから、ウエハの向きについて位置合わせをしなければならない。このためウエハにはオリフラ（オリエンテーションフラット）と呼ばれる直線状の切欠部が形成されており、これを利用して、例えば特公平 1-59739 号公報に開示されているようにローラによってオリフラ合わせを行う簡単な手法が知られている。

【0003】このようなローラを用いたオリフラ合わせは、カセット内にウエハを収納したまま一括して行うことができ、例えば熱処理をバッチで行う熱処理ステーションでは、カセットを縦にしてウエハの位置合わせを行う機構が用いられている。ところで、ウエハに対して例えばイオン注入処理やパターン焼き付け処理を行う場合には、イオン注入領域や露光領域に対してウエハが正確に載置されなければならないので、ウエハの中心位置についても位置合わせを行う必要がある。

【0004】そこでウエハの向き（オリフラの向き）および中心の位置合わせを行う方法として、従来例えば特開昭 60-85536 号公報に記載されているように、ターンテーブルによってウエハの向きを合わせると共に、当該ターンテーブルを X 方向、Y 方向に移動させてウエハの中心を位置合わせする技術や、あるいは特開昭 1-28503 号公報に記載されているようにステージ上のローラによりウエハの向きを合わせ、当該ステージをやはり X 方向、Y 方向に移動させる技術が知られている。

【0005】

【発明が解決しようとする課題】ところで、ウエハにオリフラを形成すると広い領域が切欠かれて無駄になることから、最近においてウエハの周縁にオリフラに代えて、ノッチと呼ばれる半円状の切欠部を形成することが検討されており、このためカセット内のウエハをローラで位置合わせする機構をそのまま適用できなくなる。

【0006】更にウエハのパーティクル汚染を抑えるために密閉型のウエハカセットが検討されているが、この場合にはカセット内でウエハの位置合わせを行うことができない。そこでウエハをカセットから取り出して位置合わせを行わなければならないが、例えば熱処理をパッチで行う熱処理ステーションでは、ウエハを複数枚例えば5枚一括してウエハポートに移載することから、既述のようにターンテーブルにウエハを1枚ずつ載せて行う手法はスループットが低下してしまう。

【0007】また既述のようにターンテーブルを用いてウエハの中心の位置合わせを行う手法は、X方向の駆動機構、Y方向の駆動機構を必要とし、しかもその駆動量は正確なものでなければならないので、機構が複雑になる上コスト的にも高価である。

【0008】本発明は、このような事情の下になされたものであり、その目的は、ウエハ中心の位置合わせ及び周方向の位置合わせを簡単に行うことのできる位置合わせ装置を提供することにある。

【0009】本発明の他の目的は、複数枚のウエハに対して一括して中心の位置合わせ、及び周方向の位置合わせを行うことのできる位置合わせ装置を提供することにある。

【0010】本発明の更に他の目的は、ウエハカセット内のウエハに対して中心の位置合わせを行うことのできる位置合わせ装置を提供することにある。

【0011】

【課題を解決するための手段】本発明の位置合わせ装置は、末広りのテーパ部がウエハの周縁に沿って設けられ、ウエハの周縁がテーパ部のテーパ面で規制されてウエハ中心の位置合わせが行われるように構成された中心位置合わせ用の載置部と、前記テーパ部を結ぶ円の中心部のまわりに回転すると共にこの円よりも内方側に位置する回転載置部と、前記回転載置部に保持されたウエハの周縁部の位置合わせ用切り欠き部を検出する検出部と、この検出部からの検出信号に基づいて前記回転載置部の回転量を制御してウエハの周方向の位置合わせを行う制御部と、を備え、前記中心位置合わせ用の載置部は、前記回転載置部との間でウエハの受け渡しができるように当該回転載置部に対して相対的に昇降可能に構成されたことを特徴とする。

【0012】本発明は、中心位置合わせ用の載置部及び回転載置部を一段のみ設けてもよいが、複数段設ければ、複数のウエハに対して中心及び周方向の位置合わせを一括して行うことができる。この場合、例えば各中心位置合わせ用の載置部は共通の第1の支持部材に支持されると共に、各回転載置部は、共通の第2の支持部材に支持され、第1の支持部材と第2の支持部材とを相対的に昇降させる構成を採用できる。

【0013】またウエハ移載アームによりウエハの下面を保持して位置合わせ装置に移載する場合には、テーパ

部の並びの間を、ウエハ移載アームの進入空間とし、ウエハ移載アームと中心位置合わせ用の載置部との間で両者を相対的に昇降させてウエハの移載を行う。両者を相対的に昇降させる場合、回転載置部の高さ位置を固定する一方、中心位置合わせ用の載置部を昇降可能に構成することが好ましい。

【0014】更に他の発明に係るウエハの位置合わせ装置は、周縁部の一部が開口し、その開口部からウエハの周縁部の一部が露出しているウエハカセット内のウエハを位置合わせする装置であって、ウエハが横向きになるようにウエハカセットを載置するためのカセット載置部と、このカセット載置部に載置されたウエハカセット内のウエハに対して、露出しているウエハの周縁部の少なくとも3か所をウエハカセットの外側からウエハの内方側に押圧してウエハ中心の位置合わせを行う押圧部材と、を備えたことを特徴とする。押圧部材としては、ほぼ垂直な軸の回りに回転可能なローラを用いることが好ましい。

【0015】

【発明の実施の形態】図1は本発明の実施の形態に係る位置合わせ装置を含むウエハ移載ステーションの一部を示す図であり、この移載ステーションには、密閉型のウエハカセット1と、ウエハ移載機構10と、ウエハの位置合わせ装置2とが設けられている。前記ウエハカセット1は、例えば13枚のウエハWを棚状に保持するようにウエハ保持溝が多段に形成された筐体11と、この筐体11のウエハ搬入出口である開口部を気密に閉じるための蓋体12とを備えている。

【0016】前記移載機構10は、カセット1及び位置合わせ装置2の間でウエハの受け渡しを行うためのものであるが、移載ステーションが縦型熱処理装置に組み合わせられていれば例えばウエハポートに、また真空処理装置に組み合わせられていれば例えば多段のウエハ溝を有するロードロック室にウエハを移載する。この移載機構10は、ウエハを複数枚一括して移載できるように複数の移載アーム10aを備えており、進退自在、回転自在、昇降自在に構成されていると共に、移載アーム10aの配列間隔（上下間隔）が変えられるようになっている。

【0017】本発明の実施の形態であるウエハの位置合わせ装置2は、複数段例えば5段に配列されたウエハ中心位置合わせ用の載置部である載置台3を備えている。各載置台3は、図2及び図3に拡大して示すように略リング状に形成されかつ基端側が切欠かれた昇降基台31と、この昇降基台31に、ウエハWの周縁に対応する位置に沿って例えば左右対称位置に5本ずつ合計10本配列されたテーパ部であるテーパピン4とを有している。

【0018】これらテーパピン4のうち先端側に左右に並ぶテーパピン4の間は前記移載アーム10aの進入空間を形成しており、また上下に隣接する昇降基台31の

配列間隔は移載アーム10aの配列間隔に対応している。テーパピン4は、例えばテフロン（商品名）などの樹脂で作られ、図2に示すように各々テーパ角度 $\theta$ が例えば15度で高さhが20mmの円錐状に形成されている。各昇降基台31の基端側は、角形で垂直姿勢の昇降フレーム32の左右両縁部に共通に支持されている。

【0019】また前記位置合わせ装置2は、ウエハの裏面を保持して水平に回転する回転載置部としてのターンテーブル5を5段備えている。これらターンテーブル5は、載置台3に対応して夫々固定基台51の上に設けられている。固定基台51は、対応する載置台3よりも例えば下方側に配置され、固定基台51の基端側は、前記昇降フレーム32で囲まれた空間を通り当該昇降フレーム32の背面側に位置する固定プレート52に共通に取り付けられている。この例では昇降フレーム32及び固定基台51は、夫々第1の支持部材及び第2の支持部材に相当する。

【0020】前記固定基台51の各々には駆動プーリ53やモータMなどを含む駆動部54が設けられている。ターンテーブル5は、駆動プーリ53との間に掛けられた伝達機構例えばベルト55により、前記テーパピン4を結ぶ円形領域の中心に位置する垂直な回転軸のまわりに回転できるようになっており、この例では昇降基台31よりも上方側に位置している。

【0021】前記昇降フレーム32は、前記固定プレート52の前面側に設けられた垂直なガイド56に沿って昇降機構34（図1参照）により昇降できるように構成されている。

【0022】また前記固定基台51の各々には、ウエハWの周縁に位置合わせ用の切欠部として形成された図5(a)に示すノッチ100や図5(b)に示すオリフラ（オリエンテーションフラット）200を検出するための検出部例えば受光部及び発光部を備えた光センサ41が設けられている。これら光センサ41は、ターンテーブル5にウエハWが載置されたときにそのウエハWの周縁部を挟んで発光部及び受光部が対向するように配置される。

【0023】前記光センサ41の受光出力は図2に示す制御部42に入力される。この制御部42は、この受光出力に基づいて、ターンテーブル5上のウエハWのノッチ100（あるいはオリフラ200）が所定の向きに位置するように駆動部54を介してターンテーブル5の回転量（回転角）を制御する機能を有する。

【0024】次に上述実施の形態の作用について説明する。今ウエハ移載ステーションの図示しないカセットステージに密閉型のカセット1が載置されたとする。このカセット1は、常時は蓋12によりウエハの収納空間が外部から気密に遮断されており、ウエハの移載時には図示しない蓋開閉機構により蓋12が開かれる。そしてウエハ移載機構10の移載アーム10aをカセット1内に

進入させてカセット1内の5枚のウエハWを一括して掬い上げて保持し、ウエハの位置合わせ装置2に移載する。

【0025】移載アーム10aの配列間隔は、カセット1からウエハを受け取る際には例えば10mmであるが、位置合わせ装置2に移し替えるときには、載置台3の配列間隔に対応して例えば30mmまで広がる。各移載アーム10aは図6(a)に示すように、対応するターンテーブル5から例えば5mm上方の位置まで進入する。このとき載置台3は、テーパピン4のテーパ面がウエハWの周縁より下方側に位置する高さレベルに置かれており、昇降フレーム32の上昇により載置台3が上昇し、図6(b)に示すようにテーパピン4のテーパ面によりウエハWの周縁を保持し、その保持位置から更に上昇する。これによりウエハWは移載アーム10aから浮上し、次いで移載アーム10aは位置合わせ装置2から後退する。

【0026】ウエハWはテーパピン4に保持されることにより中心の位置合わせが行われる。即ちウエハWの周縁はテーパピン4のテーパ面により規制されるため、例えばウエハWの中心がずれていれば、その中心が寄っている側の周縁がテーパピン4のテーパ面に先に当接し、テーパ面の上昇により周縁が横方向に押し返される。10本のテーパピン4は、テーパ面の同じ高さレベルにおけるポイントがウエハWの輪郭に対応する円に沿って位置するように配置されているため、図6(b)に示すようにウエハWが全部のテーパピン4で支持されたときには、ウエハ中心位置が合っている状態となる。

【0027】続いて載置台3が降下し、図6(c)に示すように載置台3上のウエハWがターンテーブル5に受け渡される。その後ターンテーブル5が駆動部54により回転するが、光センサ4の光軸はウエハWの切欠部例えばノッチ100を通るように設定されているため、制御部42側ではウエハWのノッチ100を検出でき、光センサ4の検出信号に基づいてウエハWの周方向の位置（向き）が所定位置になるようにターンテーブル5を回転させる。

【0028】こうしてウエハWの中心及び向きの位置合わせが終了し、次いで図6(d)に示すように載置台3が上昇してターンテーブル5上のウエハWを受け取る。更にウエハWとターンテーブル5との間に移載アーム10aが進入し、図6(e)に示すように移載アーム10aが上昇して載置台3からウエハWを受け取り図示しない例えば縦型熱処理装置のウエハポートに移載する。

【0029】上述の実施の形態によれば、複数枚のウエハWに対して、中心位置合わせ及び向きの位置合わせを一括して行うことができるためスループットが向上し、例えば密閉型のカセット1を用いた場合のスループット対策に有効である。テーパピン4によりウエハWの中心位置合わせを行い、このウエハWをテーパピン4からタ

ーンテーブル5に受け渡して向きについての位置合わせを行っているため、構成が簡単である。更に各ウエハ毎の位置合わせ機構が多段化されているため専有スペースも狭くて済む。

【0030】本発明では、載置台3側を固定してターンテーブル5側を昇降させ、移載アーム10aから載置台3側にウエハを受け渡すときには移載アーム10a側を昇降させるようにしてもよいが、この場合にはウエハの中心位置が最もズレている場合を見込んで移載アーム10aをテーパピン4の上方側に位置させ、そこからウエハWが降りることになるため、ウエハWの上下移動距離が大きくなり、その分光センサ41が大型化してしまう。これに対して載置台3側を昇降させれば、ウエハWが移載アーム10aから載置台3に受け渡されるまでの間、ウエハWの高さレベルは一定であるため、ウエハWの上下移動距離は小さく、従って光センサ41を小型化できる。

【0031】以上においてテーパ部としてはテーパピンの代りに、内周側がテーパ面に形成され、周方向に亘って伸びる突条部として構成し、ウエハの周縁全体（移載アームの進入空間などに対応する位置は除く）を支持するようにしてもよい。また本発明では載置台3及びターンテーブル5などからなる位置合わせ機構を多段にすることなく1段のみ設けてもよい。なお移載アームがウエハの表面を吸着するタイプのものであれば、テーパピン4の並びの間に移載アームの進入空間を形成しなくてもよい。

【0032】次に本発明の他の実施の形態について図7及び図8を参照しながら説明する。この実施の形態は、ウエハカセット内にウエハを収納したままウエハ中心の位置合わせを行うための装置である。カセットとしては、例えばSEMIで規格化が検討されている標準カセットが用いられる。図中6はウエハカセットであり、カセット載置部であるカセット載置台7の上にウエハがほぼ水平になるように横向きに置かれている。このカセット6の横置き状態における上面プレート61及び下面プレート62は、ウエハWの輪郭よりもひとまわり大きいほぼ円形状に形成され、このプレート61、62の前縁側は、ウエハWの輪郭に近い小径の円弧状に形成されている。前記プレート61、62の間における左右両側には、プレート61、62の周縁に沿った側壁63、64が設けられると共に、プレート61、62間の後端部にも壁部65が設けられ、これら壁部63、64、65の内周面には、例えば13枚のウエハの周縁部を夫々保持するための保持溝66が13段形成されている。

【0033】前記プレート61、62の円弧状の前縁部の間は、ウエハWの取り出し、取り入れ口をなす開口部67として形成されている。また壁部63、64は後側の左右両縁部は切欠かれていて、この部分におけるプレート61、62間は開口部68（図8参照）となってい

る。

【0034】前記カセット6の左右両側には、カセット6内のウエハの周縁部を押圧する押圧機構7A、7Bが対称に設けられており、本発明の実施の形態である位置合わせ装置は、これら押圧機構7A、7Bにより構成される。押圧機構7A、7Bは同一構造であり、カセット6の前縁側開口部67の左右両端付近にて露出しているウエハWの周縁部に対向する位置、つまり壁部63、64の前端面に臨む領域に対向する位置には押圧部材例えば垂直な軸部71のまわりに回動可能なローラ72が設けられている。

【0035】このローラ72は、カセット6内のウエハWに対応してウエハW毎に分割され、カセット6におけるウエハWの収納枚数分例えば13個のローラ72aが各ウエハWの高さ位置に対応して高さ方向に配列されて構成される。各ローラ72aの間には、ローラ72a、72aの間に間隔を確保するための図では見えない部材が軸部71に設けられ、ローラ72a、72a同士が擦れ合わずに回動できるようになっている。

【0036】またカセット6の後部側の左右に形成された開口部68に対向する位置にも、垂直な軸部73のまわりに回動自在な、前記ローラ72と同様のローラ74が設けられており、これらローラ72、73の各軸部71、73の下端部は、共通のスライド板8に固定されている。また各軸部71、73の上端側は互いに連結されている。

【0037】前記スライド板8は、ガイドレール81、82にガイドされながら、カセット6の前後を結ぶ中心線Lと直交する方向に進退自在に（図7中左右方向に移動できるように）構成されており、スライド板8の側部には、当該スライド板8を進退させるための駆動部例えばエアシリンダ83が設けられている。そして押圧機構7A、7Bの4本のローラ71、73は、カセット6内のウエハWの中心位置が合っているときにそのウエハWの周縁に当接するように位置設定されている。これらローラ71、73の材質としては例えばテフロン（商品名）が使用される。

【0038】上述の実施の形態では、例えば縦型熱処理装置などのカセット入出力ポートのカセット載置台7に、例えば13枚のウエハWを収納したカセット6を横向きに置く。このとき移載装置の各ローラ71、73は、カセット6と干渉しない位置まで後退しているが、カセット6が載置台7に置かれた後には、エアシリンダ83によりスライド板8を前進させ、カセット6の開口部67、68から露出しているウエハWの周縁部4箇所を夫々中心線L側に押圧し、これによってカセット6内の各ウエハWの中心位置合わせが同時に行われる。その後各ローラ71、73が後退し、図示しない搬送アームがカセット6内のウエハWを受け取りに行く。

【0039】このような実施の形態によれば、カセット

6内のウエハWに対して同時に中心の位置合わせを行うことができるので、スループットの向上を図ることができる。既述の標準カセットではウエハサイズに対して余裕をもって作られており、ウエハ中心が4mmφの中に入る程度の位置精度しかないため、本実施の形態は非常に有効である。そしてウエハの向きがある程度ラフでもよい処理に対しては、カセット内のウエハをそのまま処理ステーションに移載することができ、またウエハの向きについて正確な位置合わせが要求される場合には、その後ウエハの向きについてだけ位置合わせを行えばよいので、位置合わせのための機構も簡易なもので済む。

【0040】ウエハの周縁を押圧する部材としてはローラに限らないが、ローラを用いれば、押圧時にローラに周方向に力が加わってもローラが回転するので、擦れによるパーティクルの発生を抑えることができる。またローラとしては各ウエハに共通の1本のローラを用いてもよいが、ウエハ毎に分割したローラを用いれば、各ウエハの中心位置のずれに応じて独立に回転するので、ローラとウエハ周縁との擦れを一層抑えることができる。

【0041】なおカセットの種類は図7に示す標準カセットに限られるものではない。またウエハの周縁の押圧は、3ヶ所以上であればよく、4ヶ所に限定されるものではない。

【0042】

【発明の効果】本発明によれば、テーパ部を備えたウエハ中心位置合わせ用の載置部と回転載置部とを組み合わせるため、簡単な構成でウエハの中心及び周方向の位置合わせを行うことができる。またこれら載置部よりなる位置合わせ機構を複数段設けることにより、複数枚のウエハに対して一括して位置合わせを行うことができる。また他の発明によればウエハカセットから露出しているウエハの周縁部を、少なくとも3方向から押圧しているので、ウエハカセット内のウエハに対して中心の位置合わせを行うことができる。

【図面の簡単な説明】

【図1】本発明の実施の形態に係る位置合わせ装置を含

む移載ステーションの一部を示す概略斜視図である。

【図2】本発明の実施の形態に係る位置合わせ装置を示す斜視図である。

【図3】本発明の実施の形態に係る位置合わせ装置を示す側面図である。

【図4】本発明の実施の形態に係る位置合わせ装置のテーパピンを拡大して示す側面図である。

【図5】ウエハを示す平面図である。

【図6】ウエハの位置合わせの様子を示す作用説明図である。

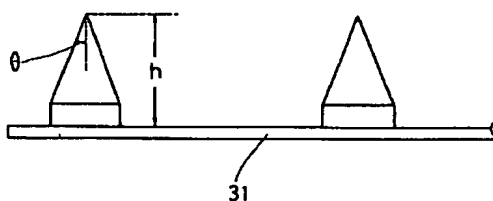
【図7】本発明の他の実施の形態に係る位置合わせ装置を示す斜視図である。

【図8】本発明の他の実施の形態に係る位置合わせ装置を示す平面図である。

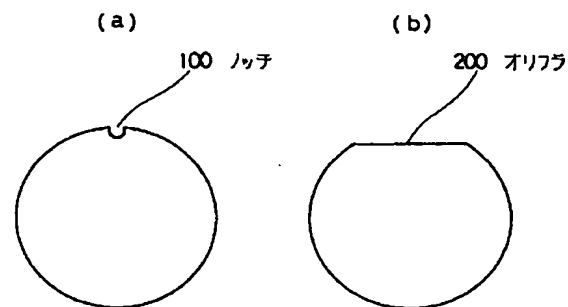
【符号の説明】

- |       |             |
|-------|-------------|
| 1     | ウエハカセット     |
| 10    | ウエハ位置合わせ機構  |
| 2     | ウエハの位置合わせ装置 |
| 3     | 載置台         |
| 31    | 昇降基台        |
| 32    | 昇降フレーム      |
| 4     | テーパピン       |
| 41    | 光センサ        |
| 42    | 制御部         |
| 5     | ターンテーブル     |
| 51    | 固定基台        |
| 52    | 固定プレート      |
| 6     | ウエハカセット     |
| 61    | 上面プレート      |
| 62    | 下面プレート      |
| 67、68 | 開口部         |
| 7A、7B | 押圧機構        |
| 72、73 | 押圧部材としてのローラ |
| 8     | スライド板       |
| 83    | エアシリンダ      |

【図4】

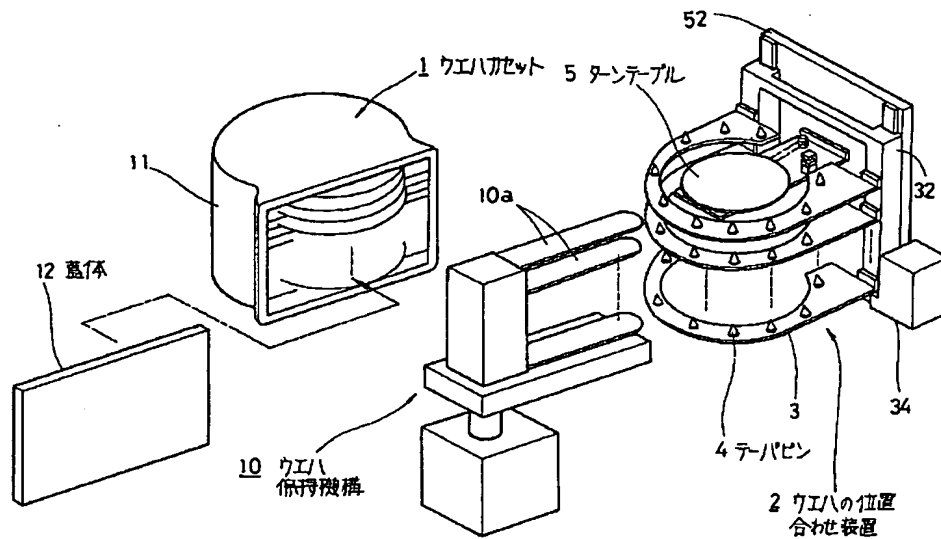


【図5】

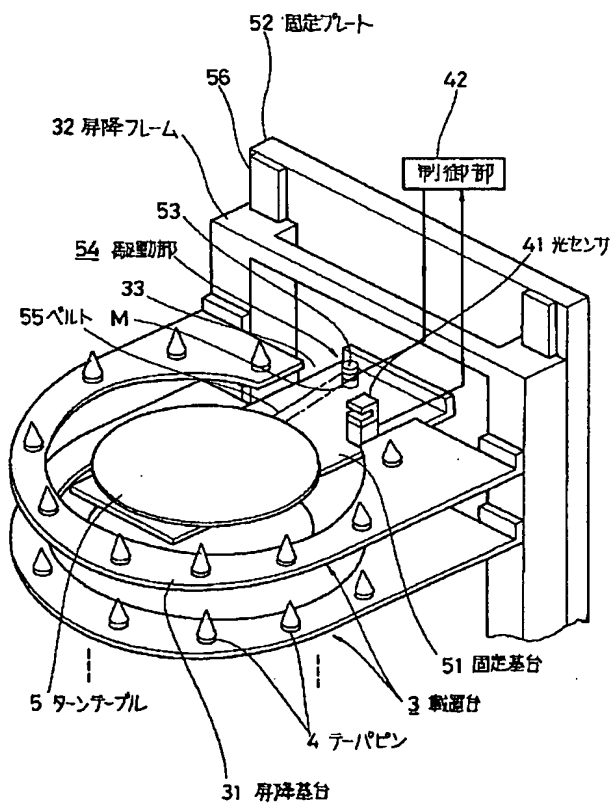




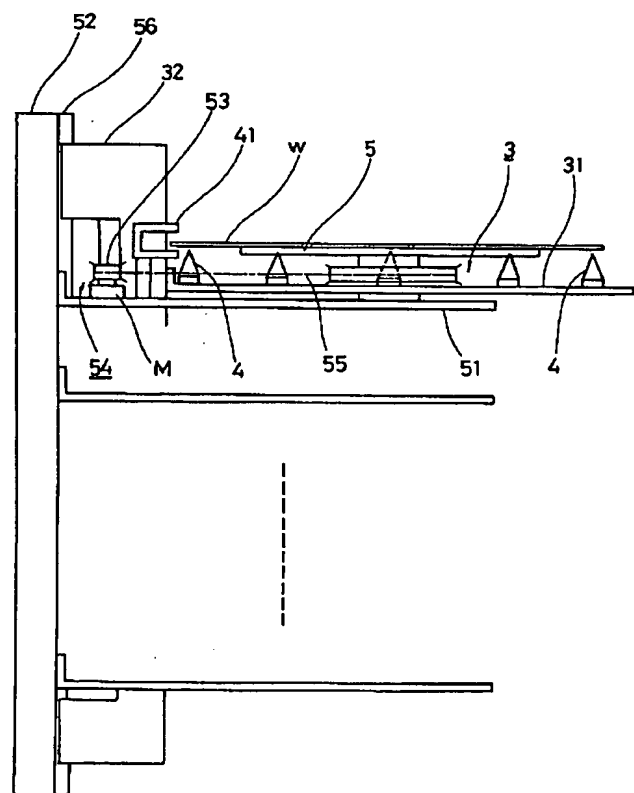
【図1】



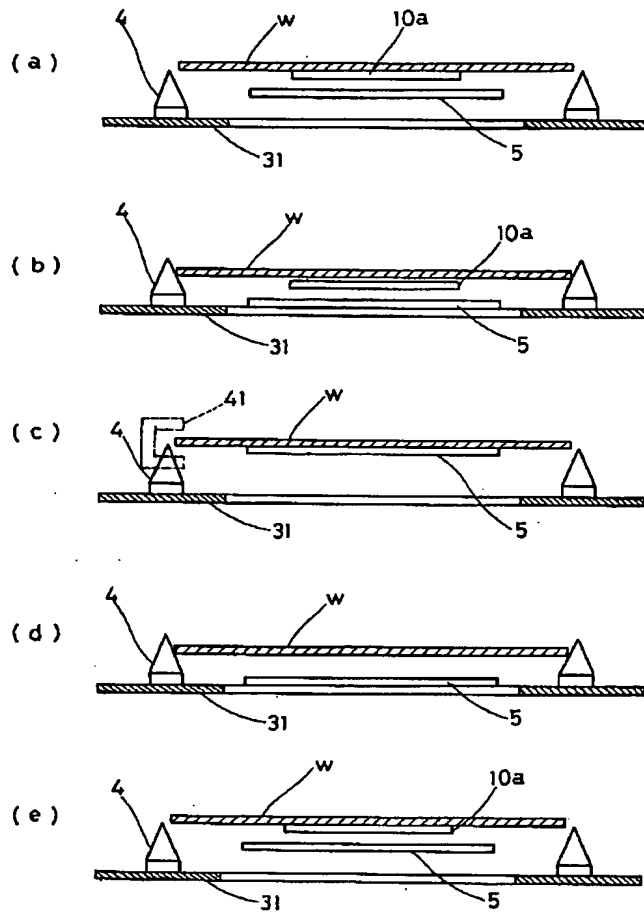
【図2】



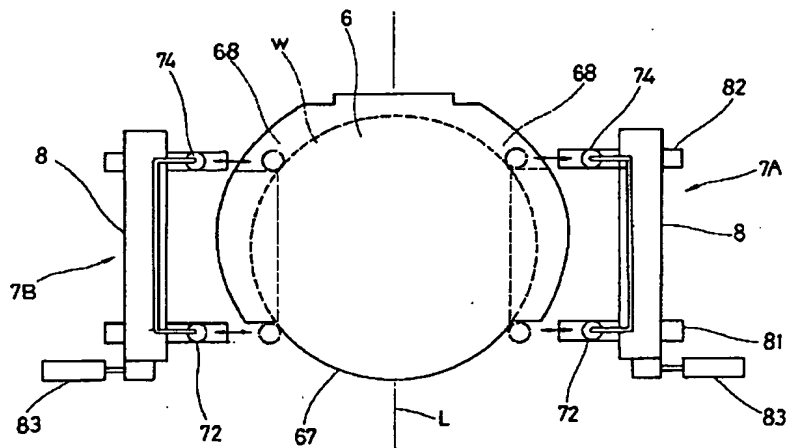
【図3】



【図6】



【図8】



【図 7】

